HANDWRITTEN SIGNATURE RECOGNITION USING SOFT COMPUTING TECHNIQUES.

For Degree of Philosophy in Computer Science
Under faculty of Science & Technology

Research Report
Submitting to
Swami Ramamand Teerth Marathwada University, Nanded

Submitted By
Sunil Tanaji Salunkhe
Research Student

Under Guidance of
Dr. Suhas Suryakant Satonkar
Research Guide & BOS Member of SRTMU, Nanded

Shri Sant Janabai Education Society's
Arts, Commerce, Science College, Gangakhed
Swami Ramanand Teerth Marathwada University,
Nanded

1. Introduction:

Signature recognition as a behavioural biometric that identifies an individual on the basis of their handwritten text. The purpose of the signature recognition process is to identify the writer of a given sample, while the purpose of a signature verification process is to confirm or reject the sample. Writing sample can be examined by way of two separate techniques.

The first technique is static. It requires the individual to supply their signature on paper, where it will be digitized through an optical scanner or camera. The data, in turn, run through a software algorithm that recognizes the text by way of analysis its shape. This technique is referred to as an "off-line" mode of recognition.

Off-line handwriting recognition is an important form of biometric identification because signatures are a socially accepted identification method which are commonly used for bank, credit card and various business transactions. Off-line signature processing is typically used in office automation systems that validate cheque, credit cards, contracts and historical documents.

2.Review of Literatures:

[1] In this paper a new on-line signature verification technique is proposed. Differently from previous works, this approach classifies a signature using a multi-domain strategy. In particular, based on the stability model of each signer, the signature is split into different segments and for each segment the most profitable domain of representation for verification purpose is detected. In the verification stage, Dynamic Time Warping (DTW) is used to evaluate the genuinely of each segment of the unknown signature, using the specific domain of representation. The experimental results, carried out on signatures of the SUSIG database, demonstrate the effectiveness of the proposed approach when compared to other approaches in literature.

[2] In this paper, they have presented a survey of various approaches and issues related to offline signature verification systems.

[3] This paper they have proposed an off-line signature verification and recognition system using pixel matching technique. PMT (Pixel Matching Technique) is used to verify the signature of the user with the sample signature which is stored in the database. The performance

of the proposed method has been compared with the existing ANN (Artificial Neural Network's) back-propagation method and SVM (Support Vector Machine) technique.

[4] In this paper, they used Pre-Trained CNN for extracts features from genuine and forged signatures, and three widely used classification algorithms, SVM (Support Vector Machine), NB (Naive Bayes) and KNN (knearest neighbors), these algorithms are compared to calculate the run time, classification error, classification loss, and accuracy for test-set consist of signature images (genuine and forgery). Three classifiers have been applied using (UTSig) dataset; where run time, classification error, classification loss and accuracy were calculated for each classifier in the verification phase.

[5] In this paper, a machine-learning single-layered Neural Network model (SOM) is discussed for signature Detection for 20 different users. The proposed concept can be extended in a more generalized form for any number of multiple users with a better tuned multi-layered NN model. Also, they were able to extract decent performance from our signature verification system using SVM for 20 different users of 200 genuine and 200 forged signatures. The result can be evaluated using FAR (false acceptance rate) and FRR (false rejection rate).

[6] In this study, they have developed three algorithms based on principle of ART-1, ART-2 and Auto-AMN. As signature verification is a bi-objective optimization problem where highest accuracy should be achieved with less time consumption, for all the three algorithms parallel methods have been proposed. The parallel implementation distributes the computation work to multiple processors and achieves the same result in a minimal CPU time. The verification is performed offline. They have also compared the performances of ART-1, ART-2 and AMN. The study revealed that ART-1 with ρ=0.89 gives 99.89% accuracy by consuming 8.37 seconds in serial and 2.28 seconds in parallel. For the case of ART-2, ρ=0.97 achieves 99.99% accuracy and time consumed is 5.86 seconds in serial and 1.58 seconds in parallel execution in a quad-core processor. For both ART-1 and ART-2 number of cluster units 'm' was set to 20. AMN takes an average of 9.58 seconds in serial and 2.98 seconds in parallel to give a detection accuracy of 75.68%. The error threshold is set to 5% in this work to make decision. However, it is completely application-based setting.

[7] In this study, the ANN algorithm used is Back Propagation. A mechanism to adaptively adjust the learning rate is developed to improve the system accuracy. The purpose of this study is to conduct the recognition of a number of signatures so that can be known whether the recognition which is done by using the Back Propagation is appropriate or not. The testing results performed by using learning rate of 0.64, the number of iterations is 100, and produces an accuracy value of 63%.

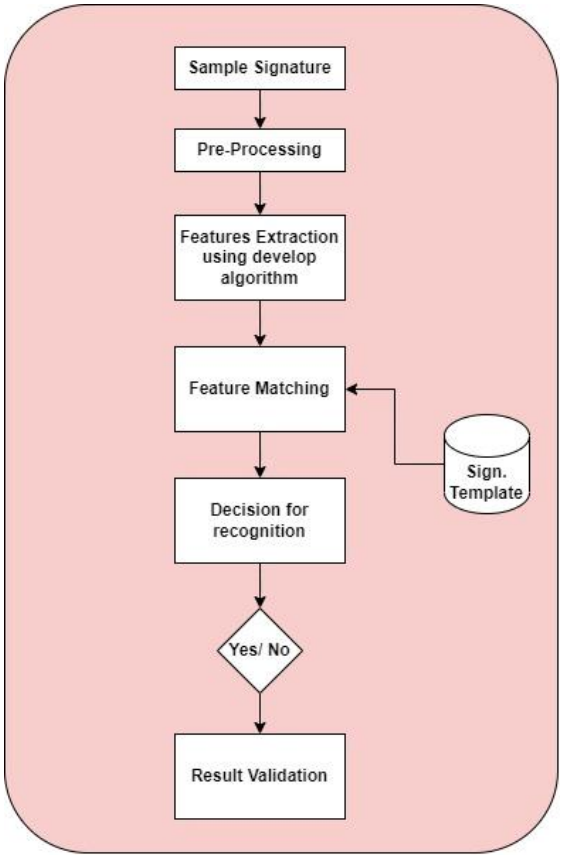
[8] The paper presents a new fuzzy approach to off-line handwritten signature recognition. The solution is based on characteristic feature extraction. After finding signature's center of gravity a number of lines are drawn through it at different angles. Cross points of generated lines and signature sample, which are further grouped and sorted, are treated as the set of features. On the basis of such structures, obtained from a chosen number of learning samples, a fuzzy model is created, called the fuzzy signature. During a verification phase the level of conformity of an input sample and the fuzzy signature is calculated. The extension in feature extraction as well as proposed fuzzy model has never been employed before. It needs to be emphasized that information stored within the verification system cannot be used to recreate the original signatures collected at the enrolment phase. The fact is particularly valuable for large databases and systems where storage safety is crucial. The solution is very flexible and allows the user to extend an intuitive structure of fuzzy sets by employing dynamic features, making the approach an on-line method.

3. Objectives of Research:

1) To study existing signature recognition techniques from the literature review.
2) To develop own signature database.
3) To develop the algorithm using different tools like python.
4) To evaluate and verify the results of developed algorithm on different techniques.

4. Methodology to be adopted:

1) To develop own signature database.
2) Noise removal and pre-processing from collected signature samples.
3) Feature extraction from pre-processed signatures.
4) Feature matching using template against test signatures.
5) Accuracy of detection on Signature Database will be calculated and shared.



5. Importance of study:

I. International status:

In the signature recognition, a neural network trained with 40 different signatures with 5 images for each. The algorithm executed on pc as a server and mobile as a client. The algorithm shows a capability to process at an average 4.7 image/sec.in each process all the algorithm execute and classify the signature. Processing rate depends on two factors, Communication delay, and processing delay. Signature recognition rate in the idle case without using the Mobile phone for image capture 99.67 and rejection rate 99.55% but these rates got difference using real-time capture using a mobile phone. This back for many reasons. first, mobile camera resolution difference from database Scanner images. second, camera focus. Third, the type of lens. Fourth, camera noise. Last, surrounding light at image capture this is the most critical factor in the operation.

II. Significance of the study:

Handwritten signature is one of the most widely accepted personal attributes for identity verification. Signature verification provides authorization in financial and business transaction. Signature verification finds its application in the field of net banking, passport verification system, provides authentication to a candidate in public examination from their signatures, credit cards, bank cheques.

6. Proposed work Plan:

Year-wise Plan of work and targets to be achieved:

I.2021-2022:

- Collection of Research Papers and Review of Literature Study.
- Complete Course Work.
- Study of python Programming Language.

II.2022-2023:

- Database Collection.
- Pre-processing of Database.
    - Noise Removal
    - Image Enhancement
    - Segmentation
- Selection of appropriate methodology
    - Selection of feature Extraction Techniques
    - Selection of Classifiers
    - Implementation of proposed research
- One or two research papers published.

III. 2023-2024:

- Feature extraction techniques implemented in python software.
- Applying the extracted features over proposed /selected classifiers.
- Result and Discussion about proposed research.
- Paper Publication.

7. References:

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Signature

Research Scholar
(Sunil Tanaji Salunkhe)

Signature

Research Guide
(Dr. Suhas Suryakant Satonkar**)**